REMARKS

Claims 1-53 and 56-76 are presented for consideration, with Claims 1, 23, 45-50, 56 and 70-76 being independent.

Independent Claims 1, 46, 56 and 72 have been amended to further distinguish Applicant's invention from the cited art.

CLAIM REJECTIONS

Claims 49-53, 75 and 76 stand rejected under 35 U.S.C. §102(e) as allegedly being anticipated by Haimi-Cohen '221. Claims 1, 11-19, 46, 48, 56, 61-65, 72 and 74 stand rejected under 35 U.S.C. §102(e) as allegedly being anticipated by Handel '502. Claims 2, 4-8, 23, 24, 26, 30, 33-45, 47, 57, 59, 66, 70, 71 and 73 stand rejected under 35 U.S.C. §103 as allegedly being obvious over Handel in view of Higgins '633. Claims 3, 25 and 58 stand rejected as allegedly being obvious over Handel, Higgins and Haimi-Cohen. Claims 9, 10, 31, 32 and 60 are rejected as allegedly being obvious over Handel in view of Higgins and Boggs '360. Finally, Claims 20-22 and 67-69 stand rejected as allegedly being obvious over Handel. These rejections are respectfully traversed.

INDEPENDENT CLAIMS 49, 50, 75 AND 76

Representative Claim 49 relates to an apparatus for determining sets of parameter values representative of an input speech signal. The apparatus includes means for receiving a plurality of speech signal values representative of an input speech signal, means for dividing the

plurality of speech signal values into a succession of groups of speech signal values, and means for processing the speech signal values in each group to determine a set of parameter values representative of the speech signal values in the group. As claimed, the processing means includes a memory for storing data defining a predetermined function which gives, for a set of speech signal values of a group, a probability density for parameters of a predetermined signal model which is assumed to have generated the speech signal values in the group, with the probability density defining, for a given set of parameter values, the probability that the predetermined signal model has those parameter values, given that the model is assumed to have generated the speech signal values in the group. The processing means also includes means for applying the set of speech signal values of a current group to the stored function to give the probability density for the model parameters for the current group, means for processing the function to derive samples of parameter values from the probability density for the current group, means for evaluating the probability density for the current group, and means for processing at least some of the derived samples of parameter values and evaluated probabilities to determine model parameters that are representative of the set of signal values in the current group.

The patent to Haimi-Cohen relates to a speech recognizer that features automatic retraining during normal use. As read by Applicant, the speech recognizer in Haimi-Cohen compares input speech signals with a set of word models each representative of a different word, as is conventional in speech recognition systems. By comparing the input speech with stored models, the system recognizes the words that have been spoken by identifying the word models most similar to the input speech. With reference to Figure 7, a hidden Markov model (HMM) is

used to model speech as a sequence of states. Each state represents a portion of the spoken word and models the acoustic features that occur in that portion of the word. The Markov model shown in Figure 7 illustrates a model evolving from an initial state S1 to a final state S10 upon successive processing of feature vectors X_i, with the states S1 . . . S10 represented by a probabilistic distribution for each state of observing a given feature vector in the state, and the characteristics of each state of the HMM are derived from a training sequence of feature vectors. In this way, as understood by Applicant, when an input speech vector X_1 is applied, a scaler value is obtained representing the probability that the feature vector corresponds to that state of the HMM. The probability values are combined with other probability values obtained by applying other feature vectors of the input utterance into Gaussian distributions of other states of the model in order to provide a score representing the similarity between a sequence of input feature vectors and the HMM.

In contrast to Applicant's claimed invention, however, Haimi-Cohen is not understood to teach or suggest, among other features, a memory that stores data defining a predetermined function which gives, for a set of speech signal values of a group, a probability density for parameters of a predetermined signal model as set forth in Applicant's Claim 49. In Haimi-Cohen, on the other hand, speech signal values applied to the HMM distributions do not provide such a probability density function. Haimi-Cohen is not read to apply a set of speech signal values of a current group to the stored function to give the probability density for the model parameters for the current group.

Similar to Claim 49, independent Claims 50, 75 and 76 also utilize a probability density function that is not taught or suggested by Haimi-Cohen.

Accordingly, it is respectfully submitted that Haimi-Cohen fails to anticipate or render obvious Applicant's invention as set forth in independent Claims 49, 50, 75 and 76. Therefore, reconsideration and withdrawal of the rejection of the claims under 35 U.S.C. §102(e) in view of Haimi-Cohen is respectfully requested.

INDEPENDENT CLAIMS 1, 46, 48, 56, 72 AND 74

Independent Claim 1 is directed to a speed processing apparatus comprised of means for receiving a set of speech signal values representative of a speech signal generated by a speech source as distorted by a transmission channel between the speech source and the receiving means, and a memory for storing data defining a predetermined function derived from a predetermined signal model which includes a first part having first parameters which models the source and a second part having second parameters which models the channel. As claimed, the function is in terms of the first and second parameters and in terms of a set of speech signal values and generates, for a given set of received signals values, a probability density function which defines, for a given set of first and second parameters, the probability that the predetermined signal model has those parameter values, given that the signal is assumed to have generated the received set of signal values. In addition, means for applying the set of received signal values to the stored function, and means for processing the function with those values

applied to obtain values of the first parameters that are representative of the speech generated by the speech source before it was distorted by the transmission channel are provided.

Handel relates to a method and system for removing noise from speech signals used in telephone systems. As asserted in the Office Action, Handel is set to include means for receiving a set of speech signal values representative of a speech signal generated by a speech source as distorted by a transmission channel, a memory for storing data defining a predetermined function, and means for applying a set of received signal values to the stored function.

As will be appreciated, however, Claim 1 has been amended to include memory for storing data defining a predetermined function which generates, for a given set of received signal values, a probability density function which defines, for a given set of first and second parameters, the probability that the predetermined signal model has those parameter values, given that the signal is assumed to have generated the received set of signal values. It is respectfully submitted that this feature, among others, is not taught or suggested in Handel.

In addition to Claim 1, Claims 46, 56 and 72 have also been amended to include the probability density function and thus can be similarly distinguished from Handel.

With respect to Claim 48, an apparatus for determining sets of parameter values representative of an input speech signal includes means for receiving a plurality of speech signal values representative of an input speech signal, means for dividing the plurality of speech signal values into a succession of groups of speech signal values, and means for processing the speech signal values in each group, to determine a set of parameter values representative of the speech

signal values in the group. As claimed, the processing means comprises means for varying the number of parameter values used to represent the speech signal values in each group.

In contrast to Applicant's claimed invention, however, Handel fails to teach or suggest, among other features, processing means that varies the number of parameter values used to represent the speech signal values in each group. On this point, the Office Action asserts that the output of element 20 and/or 30 in Figure 1 meets this feature of Applicant's invention. It is respectfully submitted, however, that Handel is read to teach the use of a predetermined number of model parameters -- predetermined p autoregressive parameters and predetermined r enhanced autoregressive parameters (see column 1, line 59 through column 2, line 11). It is submitted that Handel therefore fails to vary the number parameter values as recited in Applicant's Claim 48.

Claim 74 relates to an apparatus for determining sets of parameter values representative of an input speech signal and includes, similar to Claim 48, a processor to vary the number of parameter values used to represent the speech signal values in each group.

It is submitted that these features of Applicant's claimed invention, among others, are not taught or suggested in Handel.

Accordingly, it is respectfully submitted that Handel fails to anticipate or render obvious Applicant's invention as set forth in independent Claims 1, 46, 48, 56, 72 and 74, and therefore reconsideration and withdrawal of the rejection under 35 U.S.C. §102(e) in view of Handel is respectfully requested.

INDEPENDENT CLAIMS 23, 45, 47, 70, 71 AND 73

Representative Claim 23 relates to a speech processing method that includes the steps of receiving a set of speech signal values representative of a speech signal generated by a speech source as modified by a transmission channel between the speech source and the receiver, storing data defining a predetermined function derived from a predetermined signal model which includes a first part having first parameters which models the source and a second part having second parameters which models the channel, and applying the set of received speech signal values to the function. As claimed, the predetermined function is in terms of the first and second parameters and generates, for a given set of signal values, a probability density function which defines, for a given set of first parameters and second parameters, the probability that the predetermined signal model has those parameter values, given that the signal model is assumed to have generated the received set of signal values. Additional steps include processing the function with those values applied to derived samples of at least the first parameters from the probability density function, and analyzing at least some of the derived samples to determine values of the first parameters that are representative of the speech signal generated by the source before it was modified by the transmission channel.

In rejecting Claim 23, the Office Action asserts that the speech processing method in Handel includes the steps of receiving a set of signal values, storing data defining a predetermined function, applying the set of received signal values to the function and analyzing at least some of the derived samples. The Office Action acknowledges that Handel fails to

disclose the step of generating, for a given set of signal values, a probability density function as set forth in Claim 23.

The secondary citation to Higgins was cited to compensate for this deficiency. In Higgins, a noise suppression method is provided in which an entire utterance is processed in a first pass before noise compensation. As understood, in the first pass the speech utterance is divided into frames and FFT is performed on each frame to determine the frequency content within the frame. In the first pass, magnitude spectra are computed and saved for the entire utterance. The magnitude spectra are used to estimate the noise floor for spectra subtraction and the channel frequency response, and once these are obtained they are used in a second pass (see column 5, lines 40-54).

The Office Action asserts, on page 10, that Higgins includes the step of generating, for a given set of signal values, a probability density function as set forth in Applicant's claimed invention. It is respectfully submitted, however, that the "probability density" discussed in Higgins (column 7, lines 1-67) generates a histogram (please also see Figure 4) relating to the probability that a particular frequency component of an input signal will have a particular magnitude during an input utterance. This should be distinguished from Applicant's claimed invention in which the probability density function defines, for a given set of first parameters and second parameters, the probability that a predetermined signal model has those parameter values.

Initially, it is respectfully submitted that it would not have been obvious, absent hindsight, to combine Handel and Higgins in the manner proposed in the Office Action, as

Handel is directed to removing noise from speech signals used in telephone systems and therefore must be done substantially in real time. Higgins, on the other hand, discloses receiving an entire utterance before processing the information and suppressing the noise, and thus does not provide a method that would be conducive to real time conversation.

Nevertheless, the proposed combination of Handel and Higgins, even if proper, still fails to teach or suggest Applicant's claimed invention as set forth in Claim 23. As discussed above, Higgins does not teach or suggest providing a probability density function as set forth in Applicant's claimed invention.

Independent Claims 45, 47, 70, 71 and 73, similarly to Claim 23, also include the feature of a probability density function. For the same reasons discussed above with respect to Claim 23, therefore, Claims 45, 47, 70, 71 and 73 are also submitted to be patentable over the proposed combination of Handel and Higgins.

Accordingly, reconsideration and withdrawal of the rejection of the claims under 35 U.S.C. §103 in view of Handel and Higgins is respectfully requested.

DEPENDENT CLAIMS

With respect to the various rejections of the dependent claims under 35 U.S.C. §103 as set forth above, it is submitted that their respective independent claims are patentable in their own right for the reasons discussed above. Therefore, without conceding the propriety of combining the art in the manner proposed in the Office Action, reconsideration and withdrawal of the remaining rejections under 35 U.S.C. §103 are respectfully requested.

In this regard, the tertiary citation to Boggs relates to a speech evaluating method and was cited for its teaching of outputting a signal indicative of the quality of a received set of signal values in dependence upon a determined variance measure. Boggs fails, however, to compensate for the deficiencies in the art discussed above with respect to Applicant's independent claims.

Accordingly, it is respectfully submitted that Applicant's invention as set forth in independent Claims 1, 23, 45-50, 56 and 70-76 is patentable over the cited art. In addition, dependent Claims 2-22, 24-44, 51-53 and 55-69 set forth additional features of Applicant's invention. Independent consideration of the dependent claims is respectfully requested.

In view of the foregoing, reconsideration and allowance of this application is deemed to be in order and such action is respectfully requested.

Applicant's undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

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